Can Guest Workers Solve Japan's Fiscal Problems?

S. İmrohoroğlu, S. Kitao, and T. Yamada

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Basic Issue: Indebted and Disappearing Japan

- Three significant challenges faced by Japan
  - High debt to output ratio (close to 150%).
  - Projected increase in government expenditures due to aging population.
    - Spending to output projected to rise by 7% due to increases in pension and health spending.
  - Projected decline in 'bodies'
    - Total: 127 million in 2010 to 50 million in 2100
    - Working age: 64 million in 2010 to 20 million in 2100

- We explore the impact of various guest worker programs and immigration on the fiscal sustainability and the welfare effects on the native born workers.

What We Do

- Construct a general equilibrium model with overlapping generations of individuals
- Calibrate the model to Japanese micro data, taking earnings as exogenous
- Incorporate the projected Japanese demographics and government accounts
- Compute a benchmark transition toward a final balanced growth path
- Compute alternative transitions indexed by a particular guest worker policy
- Measure impact on the fiscal sustainability
- Compute welfare effects on current and future cohorts

The Context

- In the absence of reform of any kind, how high would the consumption tax rate go to achieve fiscal sustainability, given the projected aging and related public expenditures?
- İmrohoroğlu, Kitao, and Yamada (2013): Higher consumption tax, higher FLFP, and pension reform needed
- Hansen and İmrohoroğlu (2013): 40-60% (labor income tax rate, much worse)
- Braun and Joines (2013): 50% (co-pay reform needed)
- Kitao (2014): 45% (pension reform needed)

What We Find

- Abe's proposal (200,000 workers for 10 years)
    - 0.5 to 1.1 % points in a few years, (off of 35%)
    - 2 to 5 % points in a few decades & long run
- U.S.-style (16.4% of employment)
    - 3 to 5 % points in a 5 years
    - 6 to 10 % points in a few decades & long run
    - Immigration (200,000, eventually naturalized)
        - 5-10% points
- Very large welfare gains
    - 1 to 2 % points of CEV for current cohorts
    - 2 to 4 % points of CEV for future cohorts
- Key: Policies to mitigate the increase in K/L ratio

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High Debt

Figure : Net Debt to GNP Ratio (Ministry of Finance)

Aging Population and Public Expenditures
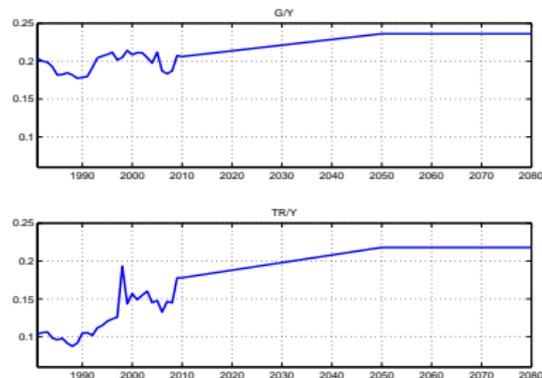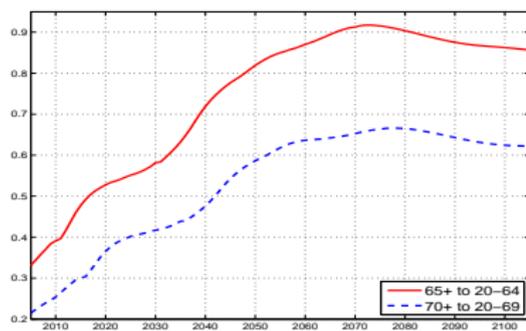
Figure : Aging and Public Expenditures. Left panel shows dependency ratios. Right panel shows government expenditure to GNP ratios (Fukawa and Sato (2009)).

Disappearing Japan
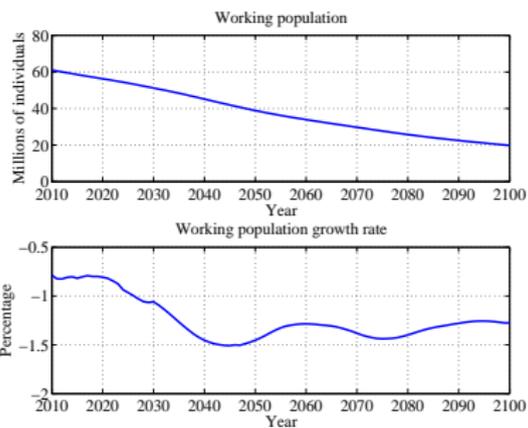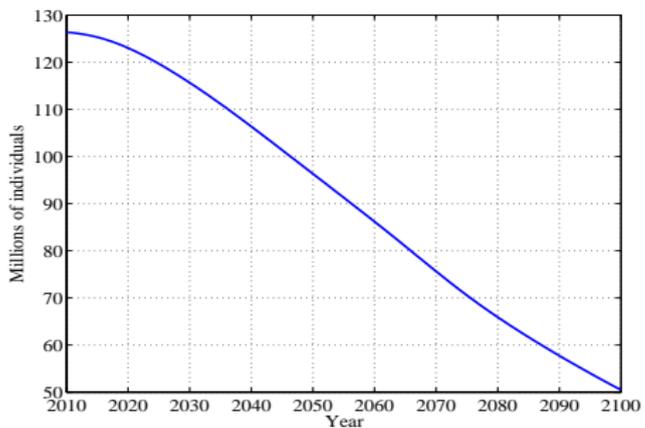
Figure : Total and Working Age Population in Japan

Related Literature

- Evaluation of the Size of the Fiscal Problem in Japan:
  - Doi, Hoshi, and Okimoto (2011)
  - İmrohoroğlu and Sudo (2011a, 2011b)
  - Hoshi and Ito (2014)
  - Hansen and İmrohoroğlu (2015)
  - İmrohoroğlu, Kitao, and Yamada (2013)
  - Braun and Joines (2014), Kitao (2015a, 2015b)
- Immigration issues:
  - Storesletten (2000, 2003), Auerbach and Oreopoulos (1999), Lee and Miller (2000)
  - Fehr, Jokisch, and Kotlikoff (2004)
  - Shimasawa and Oguro (2010)

Related to Our Paper

- Existing models assume that immigrants inherit the characteristics of native workers after one period
- Immigration results for Japan are pessimistic
    - Fehr et. al. (2004) use a 3-region OG model, 54,000 (108,000) immigrants (with capital and children same as natives), and find small welfare effects and the impact is 'too little and too late'.
    - Shimasawa and Oguro (2010) use a 16-country/region OG model, 150,000 immigrants, and find little gains on the fiscal side and that immigration alone cannot alleviate the fiscal problems
- When immigrants inherit the characteristics of natives after a period, they add to total pension expenditures.
- Hence, either have guest workers, or, allow for naturalization after a long working period

Model Overview

- Large scale overlapping generations model
- Benchmark model: *no* foreign workers
    - introduce them in policy experiments
- Individuals enter the economy at age $j = 1$, retire at j^R, can live up to J years
- Demographics:
    - $s_{j,t}$: conditional survival probability
    - $n_{j+1,t+1} = s_{j,t} n_{j,t}$: cohort size
    - Size of a new cohort: $n_{1,t+1} = \gamma_t n_{1,t}$
        - γ_t is the population growth factor

Individuals' Problem

- **Individuals maximize life time utility:**

$$U = \sum_{j=1}^{J} \beta^{j-1} S_{j,t+j-1} \frac{c_{j,t+j-1}^{1-\theta}}{1-\theta}.$$

- β: subjective discount factor
- $S_{j,t+j-1} = \prod_{k=1}^{j-1} s_{k,t+k-1}$: unconditional survival probability
- $c_{j,t}$: consumption of an individual at age j and time t
- θ: CRRA coefficient

Individuals' Problem (cont.)

- **After-tax earnings:**

$$\widetilde{y}_{j,t} = (1 - \tau_{l,t} - \tau_{p,t})y_{j,t}\Lambda_{j,t}$$

- $y_{j,t} = \eta_j w_t$: before-tax earnings
  - η_j: age-specific productivity, w_t: wage
- $\Lambda_{j,t} \in [0,1]$: employment rate of age j at t
- $\tau_{l,t}$: labor income tax rate
- $\tau_{p,t}$: payroll tax rate

Individuals' Problem (cont.)

- **Budget constraint:**

$$c_{j,t}(1 + \tau_{c,t}) + s_{j,t}a_{j+1,t+1} = \widetilde{y}_{j,t} + tr_t + p_{j,t} + R_t a_{j,t}$$

- $\tau_{c,t}$: consumption tax rate
- $s_{j+1,t+1}$: actuarially fair price of annuity
  - assume perfect annuity markets
- $a_{j,t}$: asset holdings
- R_t: after-tax return factor
- tr_t: non-pension lump-sum transfer
- $p_{j,t}$: pension benefit (> 0 if $j > j^R$)

Technology

- **Production technology:**

$$Y_t = Z_t K_t^\alpha L_t^{1-\alpha}$$

- **Factor prices:**

$$r_{k,t} = \alpha Z_t \left(\frac{K_t}{L_t}\right)^{\alpha-1} - \delta, \quad w_t = (1-\alpha) Z_t \left(\frac{K_t}{L_t}\right)^\alpha$$

- $K_t = (1 - \phi_t) \sum_j a_{j,t} n_{j,t}$: aggregate capital
  - ϕ_t: individuals allocate *exogenous* fraction of assets held as govt debt
- $L_t = \sum_j \eta_j \Lambda_{j,t} n_{j,t}$: aggregate labor

Government and Fiscal Policies

- **Government budget:**

$$B_{t+1} = (1 + r_{b,t})B_t + G_t + P_t + TR_t - T_t$$

  - B_{t+1}: issuance of new debt
  - G_t: government purchases
  - P_t: pension benefits to retirees
  - TR_t: transfers to individuals
  - T_t: total tax revenues

Government and Fiscal Policies (cont.)

- **Government budget:**

$$
\begin{aligned}
T_t &= \tau_{c,t} \sum_j c_{j,t} n_{j,t} + \sum_j (\tau_{l,t} + \tau_{p,t}) y_{j,t} \Lambda_{j,t} n_{j,t} \\
&\quad + [\tau_{k,t} r_{k,t}(1-\phi_t) + \tau_{b,t} r_{b,t}\phi_t] \sum_j a_{j,t} n_{j,t} \\
G_t &= \sum_{j,t} g_{j,t} n_{j,t} \\
P_t &= \sum_j p_{j,t} n_{j,t} \\
TR_t &= tr_t \sum_j n_{j,t}
\end{aligned}
$$

- After-tax return factor on individuals' asset holdings

$$
R_t = 1 + (1-\tau_{k,t}) r_{k,t}(1-\phi_t) + (1-\tau_{b,t}) r_{b,t}\phi_t
$$

Government and Fiscal Policies (cont.)

- **Pension Benefits:**

$$p_{j,t} = \kappa_t \frac{W_{j,t}}{j^R - 1}$$

- cumulated past gross earnings $W_{j,t}$ evolves as

$$W_{j,t} = \begin{cases} \Lambda_{j,t} y_{j,t} & \text{if } j = 1 \\ \Lambda_{j,t} y_{j,t} + W_{j-1,t-1} & \text{if } 1 < j < j^R \\ W_{j-1,t-1} & \text{if } j \geq j^R \end{cases}$$

Calibration

- **Target:** Japanese economy in 2014 (initial SS)
    - final SS: a balanced growth path with stationary population
- Demography:
    - $\{s_{j,t}\}$: National Institute of Population and Social Security Research from 2014 to 2060
    - converges to a stationary population in 2200
- Preferences:
    - $\beta = 1.0162$: $K/Y = 2.5$
    - $\theta = 2$: IES = 0.5
- Technology:
    - $A_{t+1}/A_t = 1.5\%$: per-capita output growth of about 1%
    - $\delta = 0.0821$, $\alpha = 0.3794$

Tax Rates

- **Initial SS:**
  - $\tau_l = 18\%$: Gunji and Miyazaki (2011)
    - 33% in 2007 net of pension premium 15%
  - $\tau_p = 18\%$: approximation of the premium for the employment based pension (*kosei nenkin*)
  - $\tau_k = 35\%$: corporate income tax rate
  - $\tau_t = 20\%$: tax on the interest paid on government debt
  - $\tau_{c,2014} = 8\%$

- **Transition:**
  - $\tau_{c,t}$ is endogenously determined after 2015 to satisfy government budget

Government Expenditures

- Per-capita government purchases: $G/Y = 0.18$

$$g_{j,t} = m_{j,t} + \tilde{g}_t$$

  - $\tilde{g}_t$: age-independent component of government purchases
  - $m_{j,t}$: medical expenditures covered by the government
    - Public health insurance
    - Long-term nursing care

- Replacement rate κ_t
  - adjusted by the "macroeconomic slide"

- $B_t/Y_t = 130\%$: the debt to GDP ratio in 2013

- $r_{b,t} = 1\%$

Underlying Assumptions

- **Guest workers: hand-to-mouth**
  - arrive at Japan at age 35 and stay for **10 years**
  - pay τ_l and τ_c, but they do not pay τ_p (premium)
  - consume 50% of earnings (net of consumption tax)
  - do not save domestically
    - send their earnings to their own economies
  - Japanese government incurs medical expenditures $g_{j,t}^*$ for each guest worker
    - $g_{j,t}^* = 0.5 m_{j,t}$

Guest Worker Programs

	Annual Flow of Foreign-Born Workers	Their Relative Skill Level
Experiment 1	100,000	50%
Experiment 2	200,000	50%
Experiment 3	100,000	100%
Experiment 4	200,000	100%
Experiment 5	s.t. 16.4% are foreign	50%
Experiment 6	s.t. 16.4% are foreign	100%

Foreign Born Workers: Number and Share

Experiments 1 and 2

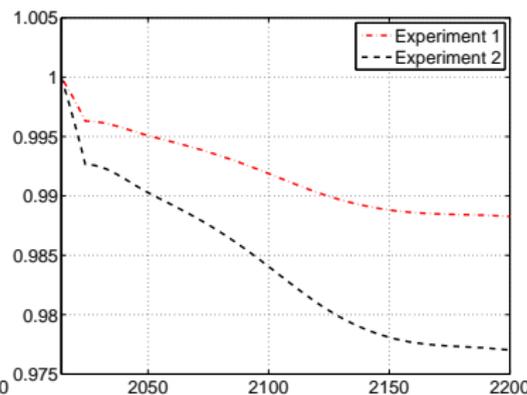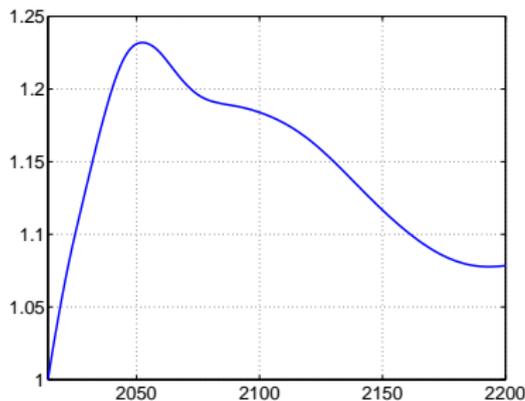|	Annual Flow of Foreign-Born Workers	Their Relative Skill Level
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Capital: Baseline and Changes
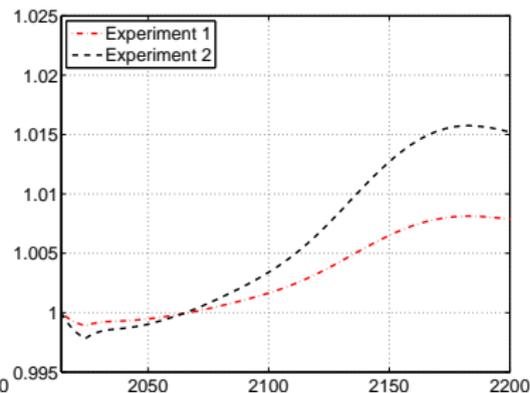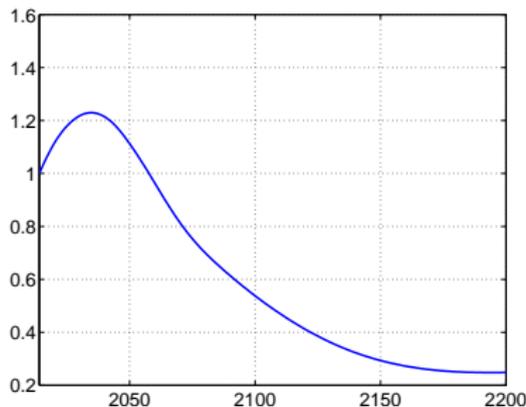
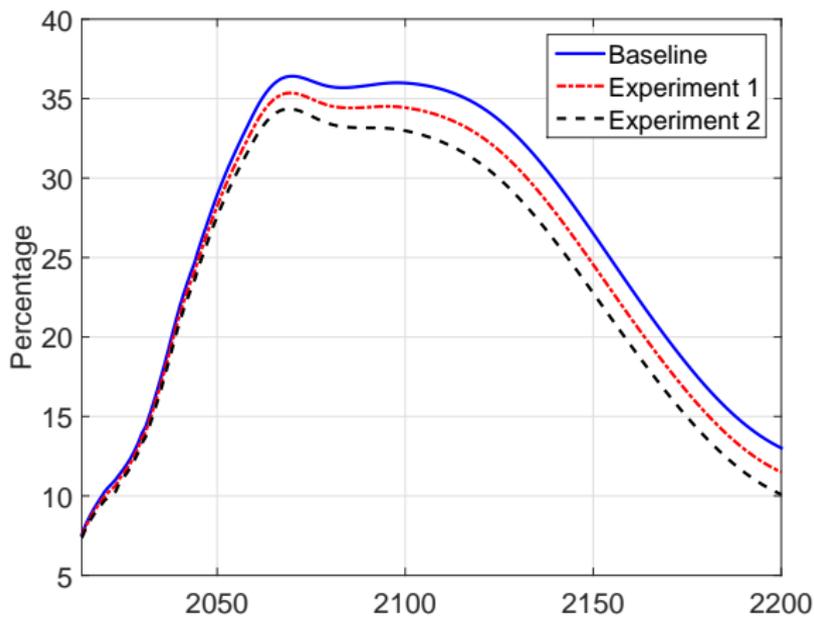# Labor: Baseline and Changes
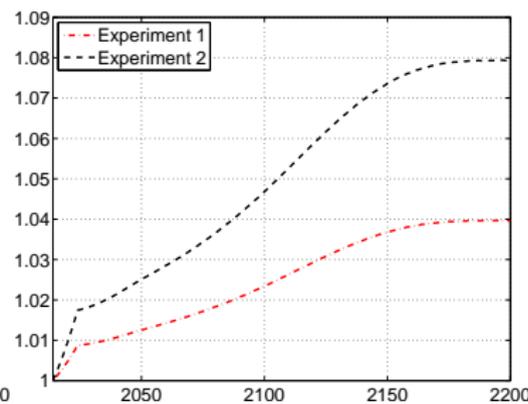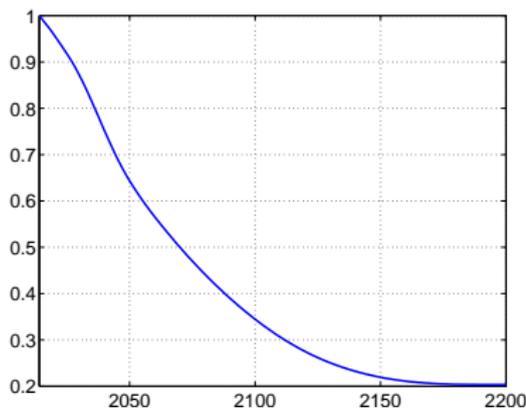
Output: Baseline and Changes
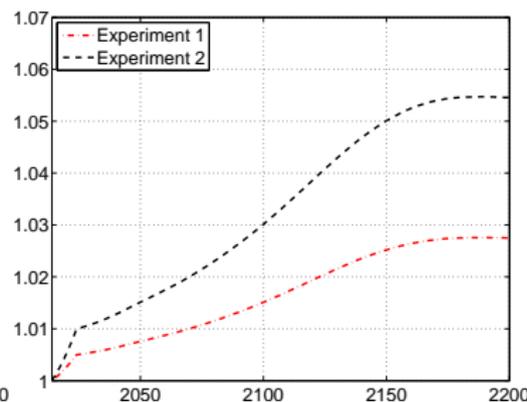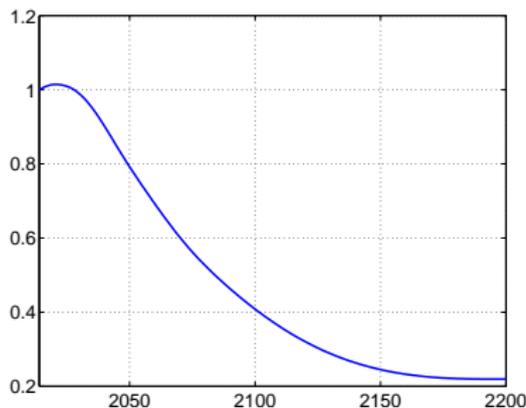
Interest rate: Baseline and Changes
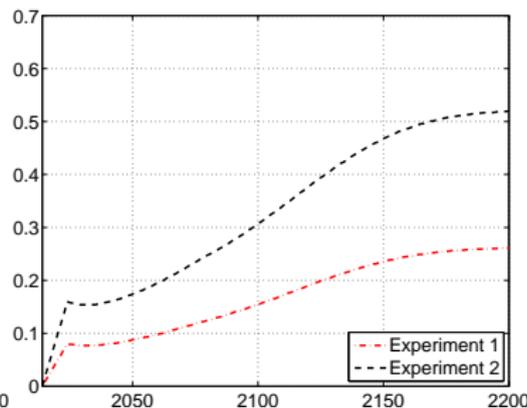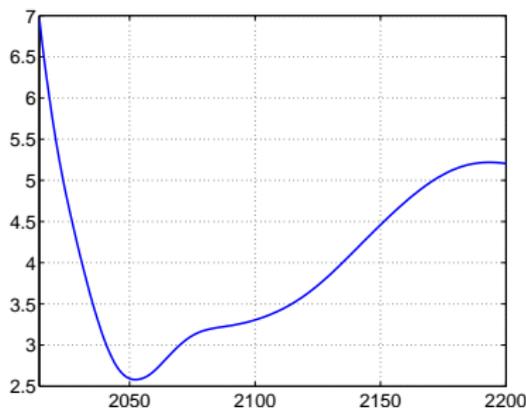
Wage rate: Baseline and Changes

Consumption tax rate

Experiments 3 and 4

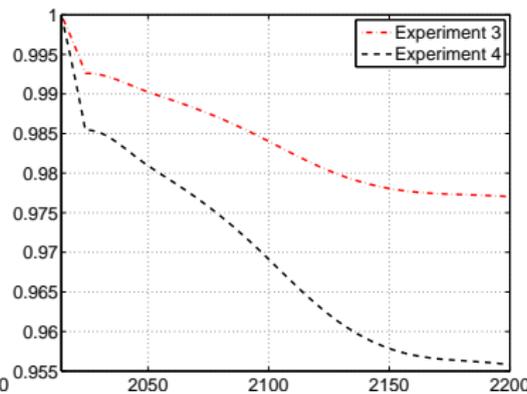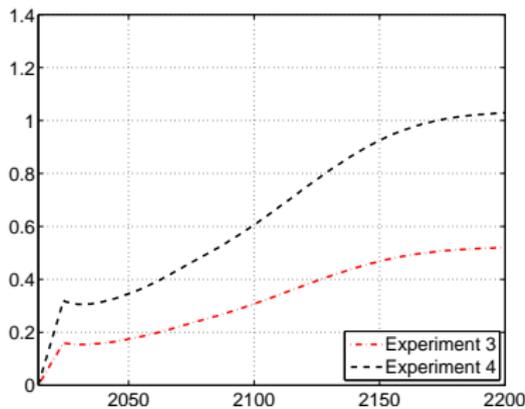|	Annual Flow of Foreign-Born Workers	Their Relative Skill Level
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Capital and Labor: Changes from baseline
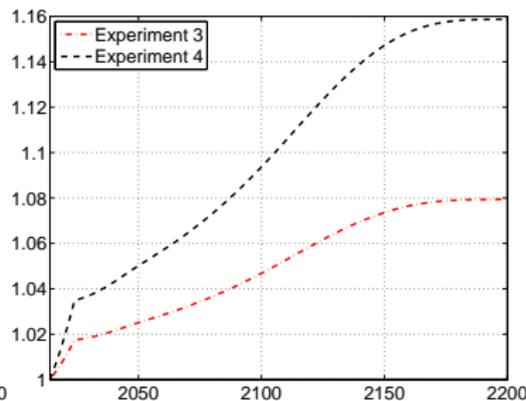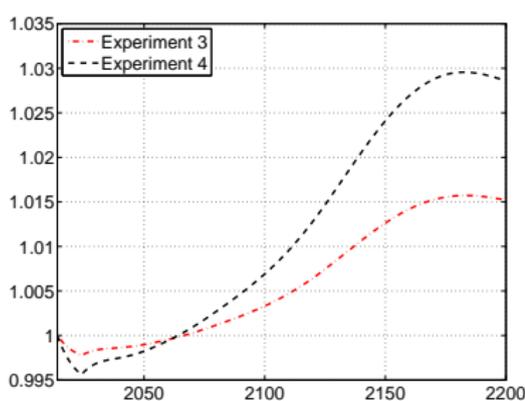
Output: Changes from baseline
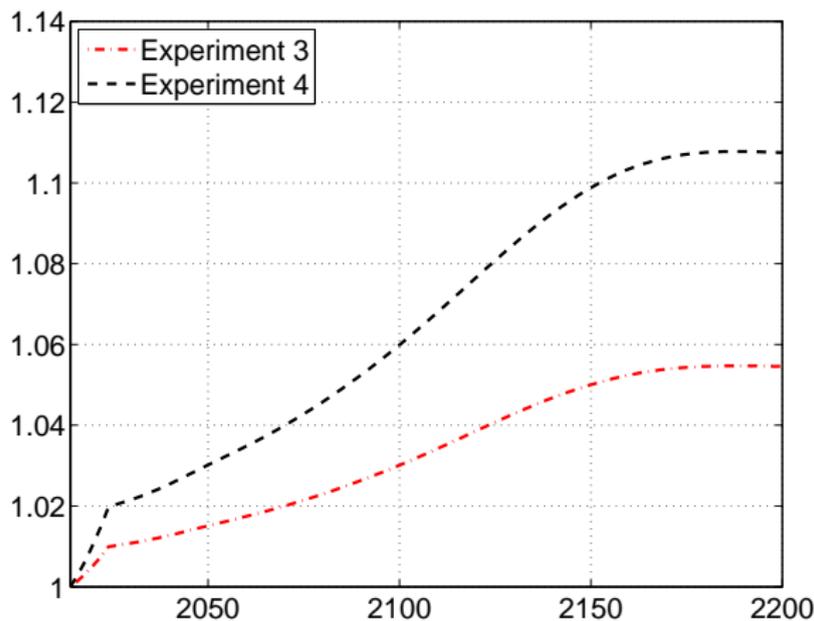
Interest rate and wage rate: Changes from baseline

Consumption tax rate
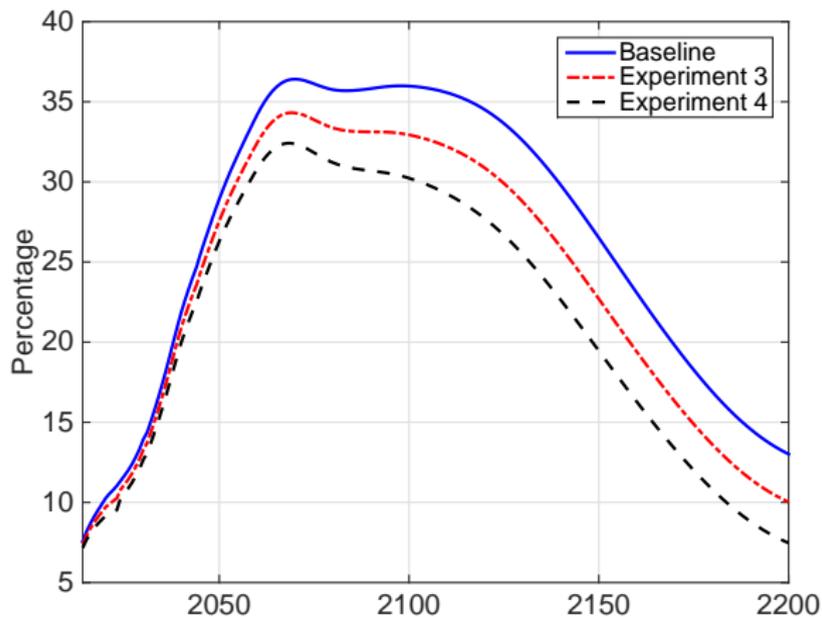
Consumption tax rate under alternative guest worker policies

	Baseline	Exp 1	Exp 2	Exp 3	Exp 4
2015	8.17	8.05	7.92	7.92	7.67
2020	10.24	9.97	9.70	9.69	9.15
2030	13.95	13.63	13.32	13.30	12.68
2040	21.88	21.40	20.93	20.92	19.99
2050	28.94	28.26	27.60	27.57	26.29
⋮	⋮	⋮	⋮	⋮	⋮
2100	35.98	34.43	32.98	32.93	30.23
∞	11.73	10.27	8.92	8.86	6.39

Experiment 5 and 6

	Annual Flow of Foreign-Born Workers	Their Relative Skill Level
Experiment 1	100,000	50%
Experiment 2	200,000	50%
Experiment 3	100,000	100%
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Consumption tax rate
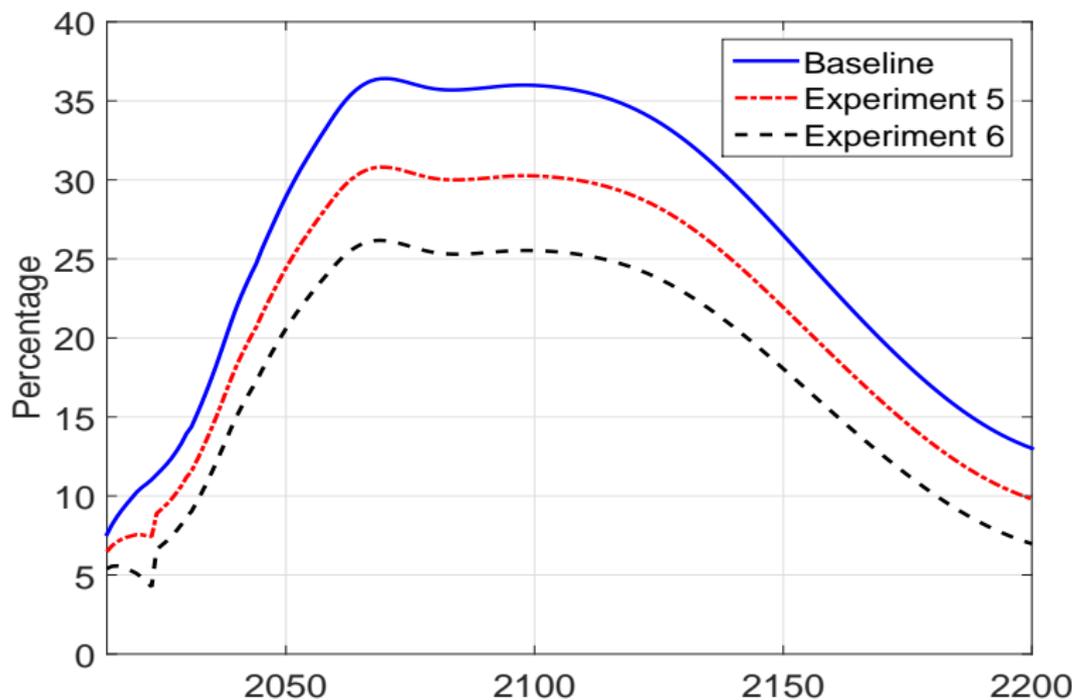
Consumption tax rate under U.S. style guest worker programs

	Baseline	Exp 5	Exp 6
2015	8.17	6.84	5.55
2020	10.24	7.56	5.09
2030	13.95	11.18	8.68
2040	21.88	18.20	14.99
2050	28.94	24.42	20.58
⋮	⋮	⋮	⋮
2100	35.98	30.25	25.50
∞	11.73	8.65	5.92

Welfare analysis: CEV

- We compute the consumption equivalent variation (CEV) for individuals at each age.

- What percent of consumption over the remaining life time each individual needs in the benchmark transition in order to achieve the same remaining life time utility under an alternative transition?

- For individuals born in 2015 and later, we compute a similar CEV that equalizes life time utilities across the benchmark and an alternative transition.

- A CEV of 1%, for example, implies that an individual is better off if a guest worker program is introduced; his remaining life-time utility would be the same in the baseline economy if his consumption in each period were raised by 1%.

Welfare Effects in Experiments 1-4
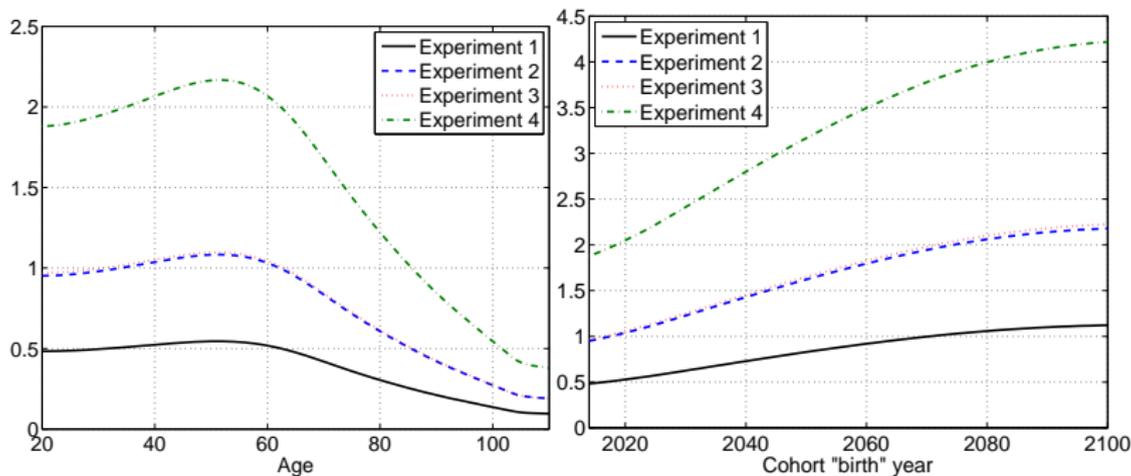
Welfare Effects in Experiments 5-6
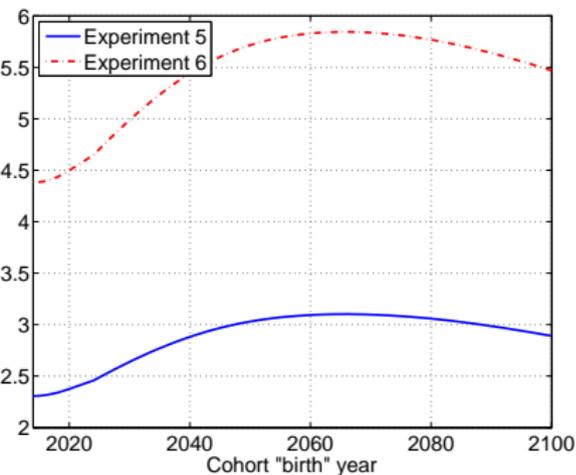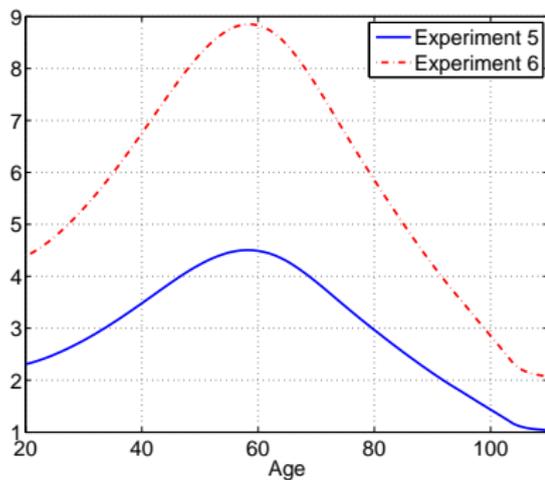
Small, open economy: fixed factor prices

- In the GE analysis above, the wage rate rises by 23% from 2014 to 2050, then declines but it is still 18% above its 2014 level in 2100.

- This is caused by a similar path for the capital-labor ratio.

- And this path is mainly driven by the sharp decline in the labor input.

- The increase in the wage rate raises the total pensions to be paid via the partial link in the formula to determine pensions.

- This is a second channel for the worsening fiscal balance.

- In this section, a partial equilibrium analysis is conducted in which the factor prices are kept constant at their 2014 GE levels.

Small, open economy: fixed factor prices

Table : Consumption Tax Rate under Partial Equilibrium

	Baseline		PE Experiments			
	GE	PE	Exp 1	Exp 2	Exp 3	Exp 4
2015	8.17	11.35	11.10	10.86	10.86	10.38
2020	10.24	12.96	12.56	12.17	12.16	11.38
2030	13.95	14.93	14.63	14.34	14.32	13.74
2040	21.88	19.76	19.41	19.06	19.04	18.34
2050	28.94	22.71	22.29	21.89	21.87	21.06
2060	34.20	24.83	24.36	23.90	23.88	22.96
2070	36.41	25.55	25.01	24.48	24.45	23.41
2100	35.98	24.69	23.91	23.16	23.13	21.67
∞	11.73	9.15	8.16	7.23	7.17	5.41

Immigration

- So far, guest workers arrive at age 35, work for 10 years and leave.
- Now, they work until their (male) life expectancy of 70 years, with the same participation rate by age as that of native-born workers.
- Most current immigrants are from China (74), Brazil (74) and Philippines (65).
- Alternatively, we could assume that they retire before age 70, but that their contributions until retirement would support their old age consumption.
- We abstract from the effects of the children of the foreign-born workers. Assuming that they become identical to native-born workers would be equivalent to increasing the fertility rates, but not by a large amount.

Immigration

Table : Consumption Tax Rate under Extended Guest Worker
(Immigration) Program

	Baseline	Exp 1	Exp 2	Exp 3	Exp 4
2015	8.17	8.07	7.96	7.96	7.75
2020	10.24	10.01	9.77	9.77	9.29
2030	13.95	13.31	12.68	12.66	11.45
2040	21.88	20.61	19.41	19.35	17.10
2050	28.94	27.12	25.45	25.29	22.20
2060	34.20	31.82	29.68	29.50	25.62
2070	36.41	33.52	30.97	30.75	26.22
2080	35.75	32.46	29.59	29.35	24.36
2100	35.98	31.77	28.23	27.93	22.00
∞	11.73	7.91	4.84	4.43	-0.53

Conclusion
Japan's Fiscal Problems

- Japan is facing a severe aging-induced fiscal problem.

- If current spending policy is maintained with debt stabilized around 150-200%, a huge consumption tax rate (50%) is needed to achieve fiscal sustainability (Hansen and İmrohoroğlu, Braun and Joines, Kitao)

- We explore guest worker and immigration programs by constructing a general equilibrium model with overlapping generations of individuals

- Calibrate the model to Japanese data, incorporate the projected Japanese demographics and government accounts, compute a benchmark transition toward a final balanced growth path, and then compute alternative transitions indexed by a particular guest worker policy

Conclusion
Benefits of Guest Workers/Immigrants

- Even a relatively small policy has measurable fiscal effects and large welfare gains
  - Consumption tax rate would be 2 to 10 % points lower relative to remaining closed to foreign-born workers
  - Welfare gains for the native-born, current workers would be 0.5 to 2% of consumption, with gains to future cohorts much larger
- A U.S.-style program essentially solves Japan's fiscal problems
  - Needed consumption tax much lower
  - Welfare gains under this program are even larger
- Political feasibility?

Conclusion
Bigger Picture: Clemens (2011, *Journal of Economic Perspectives*)

Table 1

Efficiency Gain from Elimination of International Barriers

(percent of world GDP)

All policy barriers to merchandise trade

1.8	Goldin, Knudsen, and van der Mensbrugghe (1993)
4.1	Dessus, Fukasaku, and Safadi (1999)[a]
0.9	Anderson, Francois, Hertel, Hoekman, and Martin (2000)
1.2	World Bank (2001)
2.8	World Bank (2001)[a]
0.7	Anderson and Martin (2005)
0.3	Hertel and Keeney (2006, table 2.9)

All barriers to capital flows

1.7	Gourinchas and Jeanne (2006)[b]
0.1	Caselli and Feyrer (2007)

All barriers to labor mobility

147.3	Hamilton and Whalley (1984, table 4, row 2)[c]
96.5	Moses and Letnes (2004, table 5, row 4)[c]
67	Iregui (2005, table 10.3)[c,d]
122	Klein and Ventura (2007, table 3)[e]

Conclusion
Bigger Picture: Clemens (2011, *Journal of Economic Perspectives*)

- Efficiency Gains with at least 50% emigration: 50-150% of World GDP
- Even with 5% emigration, gains are larger than that from removing all other trade/financial distortions
- Rich Economy: 1 billion people with $30,000 per year
- Poor Economy: 6 billion people with $5,000 per year
- Emigration with skill differential: gain only 60% of income differential
- With emigration, income differential falls, say, to $7,500 (half the original gain)
- 50% of poor emigrate: $23 trillion, or, 38% of World GDP
- Natives? Unskilled wage falls, return to capital rises, overall?

Conclusion
Bigger Picture: Clemens (2011, *Journal of Economic Perspectives*)

- Potential Problems
    1. Human capital externality: When migrants leave, those who stay back are worse off. Not well documented, little evidence.
    2. Labor demand at origin/destination: Evidence suggests 1-2% decline in unskilled wage in the US in a decade; 3-4% increase in wages in the origin country!
    3. Source of low productivity: Evidence suggests it is NOT who you are but WHERE you are.
    4. Is any of this politically feasible? Gary Becker and Edward Lazear 2013 suggested a fee ($50,000 for the skilled) to enter the US.

Conclusion
For Japan, What Do We Find

- Significant Economic Gains

  1. If Japan manages to keep the capital/labor ratio unchanged, then most of the problem is solved, with a consumption tax rate of 25% for 3-4 decades delivering fiscal sustainability.

  2. A guest worker/immigration program helps mitigate the rise in K/L ratio, in addition to increasing the tax base and contributing to GDP.

  3. Additional GDP produced by a guest worker is estimated to be between $20,000 (under general equilibrium and with guest workers only 50% as productive as native workers) and $66,000 (under partial equilibrium and with guest workers equally productive).